Mumbai. These systems are primarily used for scientific computation requiring super computing capabilities in the following main areas—

(i) various structural analysis calculations and simulations studies in basic and applied sciences/technologies;

(ii) development of systems software for large parallel date base applications; and

(iii) parallelising of weather forecasting programme for medium range weather forecasting.

At Indian Institute of Technology, Mumbai, the Anupam Computer system is being used for solving computational fluid dynamics problems and for development of system software for large parallel data base applications. The Anupam Super Computer has also been used for parallelising the weather forecasting programs, namely T/80 Model and SSI analyse, wich are operational and Cray XMP/216 Supet Computer at the National centre for Medium Range Weather Forecasting, Department of Science & Technology, New Delhi. It was observed that a 16 node Anupam System would be albe to execute both the weather forecasting codes at the same speed as the single processor Cray/XMP.

(c) At present there is no demand from abroad for the vailable Anupam Super Computer system which is based on INTEL 1860 microprocessor chips.

(d) many advanced courses on the use of the Anupam System for large computational jobs have been conducted at various institutes both within the country and abroad. Scientists of Bhabha Atomic Research Centre have participated actively in the workshops abroad and in India with a view to imparting practical training on parallel processing technology.

Capabilities of Indian Nuclear Programme

2721. SHRI SURINDER KUMAR SINGLA:
DR. SHRIKANT RAMCHANDRA JICHKAR:

Will the PRIME MINISTER be pleased to state:

(a) whether the Indian Nuclear Programme has developed technical capabilities in all segments of the nuclear fuel cycle;

(b) if so, what are the salient features;

(c) to what applied use these are being put; and

(d) what steps are being taken to make more advancements in this area?

THE MINISTER OF STATE OF THE MINISTRY OF PLANNING AND PROGRAMME IMPLEMENTATION AND MINISTER OF STATE OF THE MINISTRY OF SCIENCE AND TECHNOLOGY (SHRI YOGINDER K. ALAGH): (a) Yes, Sir. India is one of the few countries in the world which has acquired comprehensive indigenous capability in all aspects of the nuclear fuel cycle. The nuclear fuel cycle consists of a chain of activities comprising survey and exploration of atomic minerals by Atomic Minerals Division; exploitation of the resources and production of uranium concentrate by Uranium Corporation of India Limited; fabrication of nuclear fuel required for nuclear reactors by the Nuclear Fuel Complex; the production of heavy water by the heavy Water Board; the construction and operation of nuclear power plants by the Nuclear Power Corporation of India Limited and reprocessing of spent fuel and safe disposal of atomic wastes by Bhabha Atomic Research Centre. All these nuclear fuel cycle activities are packed up by an extensive R&D programme.

(b) Indian nuclear programme has evolved a three stage strategy to generate nuclear power using its moderate natural resources of uranium and vast resources

of thorium. The first stage which deploys pressurised heavy water reactors and produces power and plutonium has attained commercial maturity. India has desigend and constructed its own pressurised heavy water reactors and also the associated fuel cycle facilities plants based on Technologies developed in the Bhabha Atomic Research Centre with the corporation of Indian industries. The second stage comprising development of fast broader reactors is at the demonstration phase. An experimental reactor is operational in the Indira Gandhi Centre for Atomic Research it Kalpakkam with indigenously developed fuel of mixed carbide of uranium and plutonium. The technology with respect of the third stage, namely, utilisation of thorium is in experimental stage, with the commissioning of the indigenously designed KAMINI which utilises uranium-233 fuel.

(c) Apart from generation of electricity, the programme covers beneficial uses of atomic energy in the fields of medicine, agriculture and industry.

(d) Continuous development in all parts of the nuclear fuel cycle, including the design of an Advanced Heavy Water Reactor and the Prototype Fast Breeder Reactor and other related areas of accelerators and lasers is in progress.

Development of Desalination Technologies by BARC

2722. SHRI SURINDER KUMAR SINGLA:
DR. SHRIKANT RAMCHANDRA JICHKAR:

Will the PRIME MINISTER be pleased to state:

(a) what have been the results of the two-decade long work of BARC in the area of desalination technologies;

(b) whether any development in these areas has taken place due to the above work;

(c) whether any pilot projects were undertaken;

(d) if so, the results thereof; and

(e) the works being undertaken in this field?

THE MINISTER OF STATE OF THE MINISTRY OF PLANNING AND PROGRAMME IMPLEMENTATION AND MINISTER OF STATE OF THE MINISTRY OF SCIENCE AND TECHNOLOGY (SHRI YOGINDER K. ALAGH): (a) As a result of two decades of Research and Development (R&D) work on desalination at the Bhabha Atomic Research Centre (BARC) it has been now possible to develop desalination technology in the country to provide safe potable water in brackish water areas.

(b) Yes, Sir. The technology of reverse osmosis (membrane process) and multi stage flash (evaporation process) have been successfully developed.

(c) Yes, Sir. A number of pilot projects were undertaken on both the technologies. These are (i) 425 M^3/Day MSF plant for sea water desalination, (ii) 30T/D shipborne desalination plant, (iii) 50 M^3/D RO effluent treatment plant and (iv) 15M^3/D RO pilot plant for producing ultra pure water.

Two numbers of 50m^3/D RO plants were set up in eighties in the villages of Andhra Pradesh and Gujarat for studying the feasibility of providing safe potable water from available brackish sources.

(d) The successful operation of 425M^3/D MSF plant has provided useful data for design and fabrication of commercial size plant. The 30 T/D shipborne desalination plant utilises low temperaure evaporation and can be used on waste beat sources thus saving energy. The RO plants are capable of converting brackish water into safe potable water. These are also useful for water and effluent water treatment for water reuse.

(e) Based on experience gained from our R&D work, a 6300 M^3/Day